

A NEW CRETACEOUS CRAB, *DIAULAX MILLERAE*  
(CRUSTACEA: DECAPODA), FROM THE  
NORTHERN ATLANTIC COASTAL PLAIN, U.S.A.

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*Abstract.*—Two specimens representing a new species, *Diaulax millerae*, of a Cretaceous crab were collected from spoil banks of the Chesapeake and Delaware Canal from the lower Campanian Merchantville Formation. The new species is characterized by a hexagonal, relatively flat carapace with moderately developed grooves and prominent tubercles on the epibranchial dorsal shield margins. The specimens are preserved as internal carapace steinkerns enclosed in apatite concretions associated with numerous decapods of the Chesapeake and Delaware Canal Assemblage. The description of *D. millerae* extends the stratigraphic range of *Diaulax* from the Early Cretaceous into the Late Cretaceous. Review of the stratigraphic and geographic distribution of *Diaulax* shows a possible pattern of development along the northern margin of the Tethys Seaway in Texas followed by an eastern migration into Great Britain during the Early Cretaceous, then immigration into the opening Atlantic during the Late Cretaceous.

The apatite-preserved, decapod-rich fauna of the Merchantville Formation from the Chesapeake and Delaware Canal described by Roberts (1962) consists of six taxa of lobsters, two thalassinoid taxa, one hermit crab taxon, and eleven taxa of brachyuran crabs found in association with abundant invertebrates:

Lobsters

*Enoploclytia* sp.  
*Hoploparia gabbi* Pilsbry, 1901  
*Hoploparia gladiator* Pilsbry, 1901  
*Oncopareia* sp.  
*Archaeocarabus?* *whitfieldi* (Pilsbry, 1901)  
*Linuparus richardsi* Roberts, 1962

Hermit Crabs

*Palaeopagurus pilsbryi* Roberts, 1962

Burrowing Shrimp

*Protocallianassa mortoni* (Pilsbry, 1901)

*Protocallianassa praecepta* Roberts, 1962

Crabs

*Raninella tridens* Roberts, 1962  
*Notopocorystes testacea* (Rathbun, 1926)  
*Homolopsis atlantica* Roberts, 1962  
*Homolopsis dispar* Roberts, 1962  
*Tetracarcinus subquadratus* Weller, 1905  
*Necrocarcinus rathbunae* Roberts, 1962  
*Paranecrocarcinus gamma* Roberts, 1962  
*Prehepatus dilksi* Roberts, 1962  
*Xanthosia elegans* Roberts, 1962  
*Xanthias?* *lenolensis* Rathbun, 1935

Collecting in the spoil piles of the Chesapeake and Delaware Canal during canal construction in the early 1970's led to the accumulation of abundant, beautifully preserved specimens designated herein as the Merchantville Chesapeake and Delaware

Assemblage. Two specimens, collected in the 1970's by Cynthia Miller and William Beck which are not assignable to any existing taxon, are described herein and named *Diaulax millerae*. They were transmitted to me for study by Harry Mendryk. The Chesapeake and Delaware Decapod assemblage represents the preserved fraction of a decapod association which existed on the Northern Atlantic Coastal Plain during mid-early Campanian time (Owens et al. 1970:32).

The decapod portion of the Merchantville fauna from the Chesapeake and Delaware Canal consists of approximately 2000 specimens. The low rate of incidence of *D. millerae* (abundance of 0.1%) in the Merchantville Chesapeake and Delaware Canal Assemblage indicates the probability of collecting additional specimens of this species will be very small. The description of *D. millerae* increases the completeness of the North American record for *Diaulax* (Glaessner 1969).

Type specimens of the new species are deposited in the collection of the National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560 (USNM).

### Systematic Paleontology

Section Podotremata Guinot, 1977

Subsection Dromiacea de Haan, 1833

Family Dialacidae Wright & Collins, 1972

Genus *Diaulax* Bell, 1863

*Type species.*—*Diaulax carteriana* Bell, 1863 (= *Platypodia oweni* Bell, 1850) is cited as the type species by monotypy (Wright & Collins 1972).

*Diagnosis.*—Carapace more or less hexagonal, length more or less equal to width, widest at anterior  $\frac{1}{3}$ , moderately arched longitudinally, especially anteriorly; transversely flat; lobes somewhat tumid, moderately differentiated; cervical and branchiocardiac grooves weakly developed, transverse; front generally downturned; lateral margins sharply reflexed, ornamented

by small spines, slightly convergent posteriorly; posterior margin convex, bordered by broad groove. Rostrum pointed or squared, downturned, may be sulcate with edges turned upward into lobes; orbits small.

*Discussion.*—*Diaulax* is known from the Lower Cretaceous (lower Albian) Glen Rose Limestone of central Texas, from the Lower Cretaceous (middle and upper Albian to lower Cenomanian) of Great Britain, and, with the description of *D. millerae*, its range is extended into the Upper Cretaceous of North America (mid-lower Campanian of the Northern Atlantic Coastal Plain). The assignment of this taxon to *Diaulax*, necessitating an emendation of the generic diagnosis, constituted a conservative taxonomic approach taken instead of creating a new genus-level taxon. This action was necessary because *D. millerae* is longer than wide rather than wider than long. Relative carapace width and length is a characteristic which is judged to be easily changed in the evolution of brachyurans.

*Diaulax millerae*, new species

Fig. 1

*Synonymy.*—*Diaulax* sp., Bishop 1986, p. 133.

*Diagnosis.*—Carapace more or less hexagonal, longer than wide, widest near ends of cervical groove; longitudinally flat, somewhat downturned anteriorly, moderately to poorly grooved with weak cervical and branchiocardiac grooves; lateral margins convergent posteriorly; regions smooth to finely granulate, non-tumid.

*Types.*—Holotype (USNM 462295) and paratype (USNM 462296).

*Occurrence and preservation.*—Specimens of *Diaulax millerae*, preserved as internal steinkerns enclosed in apatite concretions, with some appendages visible on the surface of the concretions, were collected on construction dredge spoils at the Chesapeake and Delaware Canal, Newcastle County, Delaware. These spoil piles were

produced during construction of a new canal section and are from the Merchantville Formation.

*Description.*—Carapace hexagonal, longer (18.2 mm) than wide (14.1 mm), widest just anterior to ends of cervical groove approximately 0.40 the distance from the front. Anterior margin convex, rostrum produced anteriorly beyond orbits, sulcate with mesial ridge, bilobed; anterolateral margins rounded to widest part anterior to intersection with cervical groove; lateral margins broadly rounded, somewhat straighter posterior to cervical groove, convergent posteriorly; posterolateral edge somewhat sinuous angular; posterior margin sinuous, concave at middle, bordered by narrow rim. Dorsum relatively flat, regions (as defined by Wright & Collins 1972: fig. 1) poorly delineated by broad, shallow grooves. Cervical groove discontinuous across gastric region, moderately incised from gastric ridge to edge of dorsum, not visible across gastric ridge, separating the dorsum into an anterior portion (cephalic arch of Milne-Edwards as defined by Bell 1858, iii) and a posterior portion (scapular arch of Milne-Edwards as defined by Bell 1858, iii). Groove delineating mesogastric very shallow and poorly defined, sweeping backward and outward from the rostrum, nearly joining cervical groove. Branchiocardiac groove broad and shallow, transverse and somewhat sinuous, rather deeply incised across sagittal ridge where it splits, one branch reflexed sharply anteriorly and distally to form broad depression oriented as if to join junction of mesogastric and cervical grooves, the other branch looping posteriorly, then outward around epimeral peninsula, again splitting with another branch bounding anterior and lateral margins of the cardiac lobe and nearly coming together at posterior of cardiac lobe. Epimeral peninsula raised and continuous with narrow, but prominent, ridge immediately posterior to transverse branch of branchiocardiac groove.

Cephalic arch (as used by Milne-Edwards

as defined by Bell 1858, iii) broad and bulbous; faintly differentiated by mesogastric grooves into mesogastric and large distal epigastric-protogastric-hepatic regions; epigastric regions faintly produced into raised bosses; hepatic and protogastric regions somewhat differentiated by broad, shallow hepatic depression [=hepatic groove]. Mesogastric lobe with long, narrow anterior tongue extending onto the rostral area which is apparently downturned into a bifurcated rostrum, gradually widening posteriorly to triangular mesogastric lobe. Orbits well defined, 47.2% of carapace width, inner and outer orbitals separated by narrow, sharp, granulate inner rim; outer orbital margin ringed by narrow, granulate rim, terminating in prominent extraorbital projection at outermost angle.

Scapular arch delimited by shallow furrows into gastric region and branchial lobes. Gastric ridge barely differentiated by cervical furrow between mesogastric and urogastric lobes, well defined by branchiocardiac groove. Cardiac region distinct, separated from urogastric lobe by broad groove, somewhat keyhole-shaped, with 3 tubercles arranged in isosceles triangle, base anterior. Branchial region differentiated into small, anterior epibranchial-mesobranchial region and large, posterior metabranchial region. Mesobranchial region only faintly separated from distal epibranchial region by very shallow groove splitting off cervical groove. Epibranchial region inflated and angular, forming epibranchial angle and widest portion of carapace accentuated by curvature of cervical furrow around a moderately-sized epibranchial spine on the dorsal edge. Mesobranchial region forms a somewhat sinuous transverse ridge. Metabranchial region mostly flat but with narrow, prominent ridge and broad depression anteriorly.

Pterygostomial region wide and tightly reflexed beneath carapace; mouth frame with straight, subparallel margins raised into narrow rim, diverging posteriorly to meet

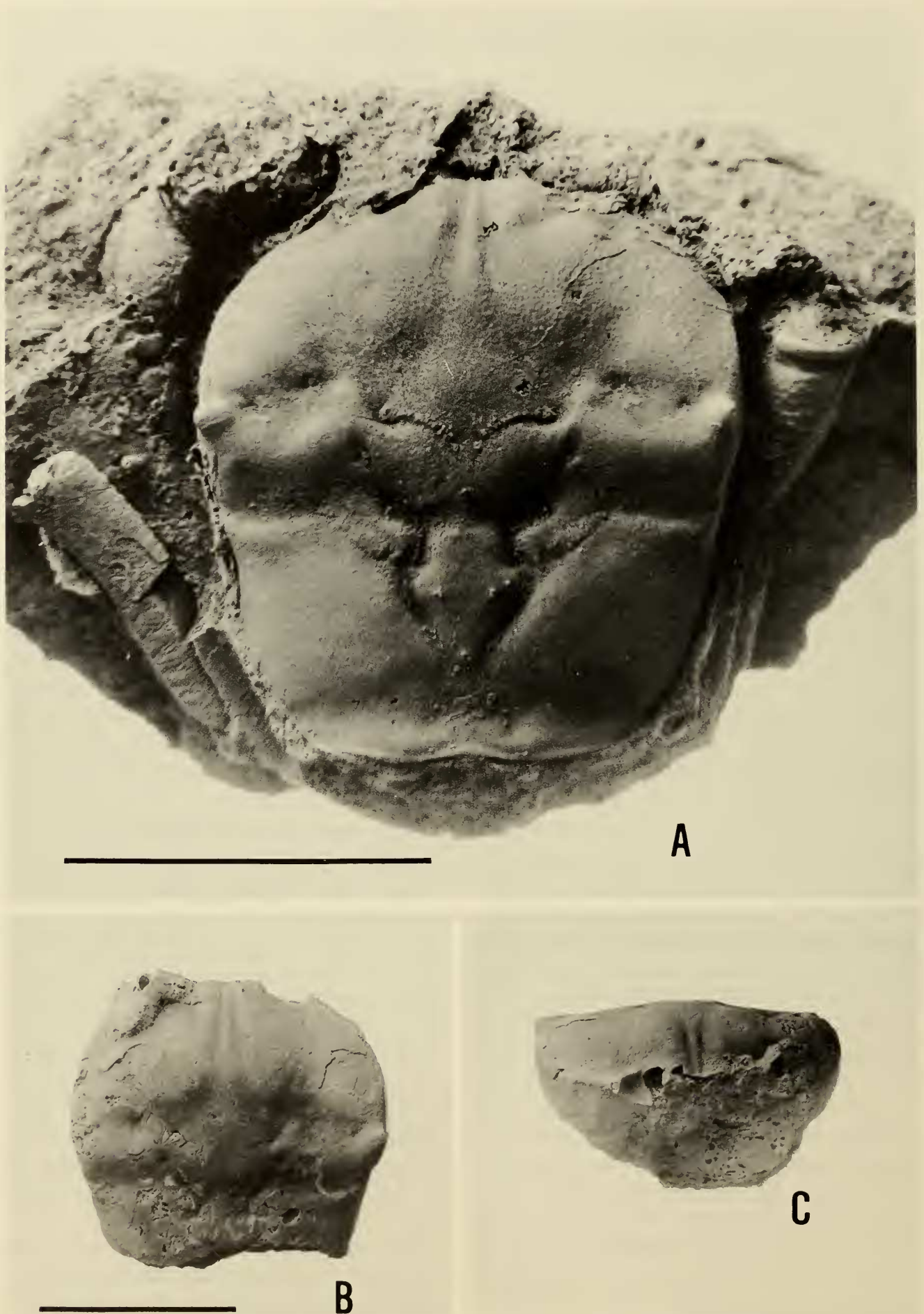


Fig. 1. Photographs of *Diaulax millerae*, new species, embedded in concretion; A. Dorsal view of holotype, B. Dorsal view of paratype, C. Anterior view of paratype. (Scales = 1 cm.)

sternum. Pterygostomial region with two subparallel depressions, the anterior-most sweeping in from dorsal shield edge and continuous with transverse branch of branchiocardiac groove, the other short and not continuous to dorsal shield edge or mouth frame. Pleural suture follows anterior-most groove for about 0.66 of its distance from front to back. The cervical furrow becomes obsolete at the dorsal shield edge on the upper surface of the carapace, but its position can be traced by its smoothness relative to the finely granulate surface of the rest of the pterygostomial region. It enters the pterygostomial region just anterior to the epigastric spine, runs parallel to the extension of the branchiocardiac groove to the middle of the pterygostomial region where it splits, one branch rising to the anterolateral edge of the dorsal shield and the other running to the extension of the branchiocardiac groove.

Chelipeds approximately equal; merus stout; carpus pentagonal, moderately sized; propodus short and high, strongly granulate (at least on inner face); dactylus long, narrow, and strongly curved downward. Pereiopods 2 and 3 have stout meri; other thoracopods unknown.

*Etymology.*—This species is named in honor of Cynthia Miller who collected the holotype.

*Comparison.*—*Diaulax millerae* is easily distinguished from its North American congener *Diaulax roddai* Bishop 1983, by its difference in outline which is sub-hexagonal rather than kite-shaped as in *D. roddai*, by the anterior margin lacking the prominent extraorbital angles of *D. roddai*, by having an inflated and rounded cephalic arch which is inflated and rounded rather than flat and somewhat depressed as in *D. roddai*, and by differences in ornament including prominent epibranchial tubercles which are lacking in *D. roddai*. *D. millerae* is similar in carapace outline to *D. oweni* (Bell 1850) but differs by being longer, by having less tumid lobes, and more rounded anterolateral margin not interrupted by anterolateral spines

as in *D. oweni*. *D. millerae* differs even more from *D. feliceps* Wright & Collins 1972, in outline, being relatively much longer, and in differences in the shape of the cervical and branchiocardiac grooves, and by having a rounded anterolateral margin rather than straighter deeply invaginated anterolateral margins of *D. feliceps*.

*Remarks.*—The preservation of a fossil such as *D. millerae* does not present the complete complement of morphologic information, particularly on the exterior surface of the cuticle and the distal parts of the appendages, however the gross morphology preserved is adequate to define this new taxon. The complete description of this crab's morphology must await additional specimens found with preserved exoskeleton and appendages. The presence of *D. millerae* in the Chesapeake and Delaware Canal Merchantville Decapod Assemblage reemphasizes the need for large collections of decapods from apatite-preserved decapod-rich assemblages. Only collections consisting of hundreds or thousands of decapods are likely to have a significant chance of yielding scarcer faunal elements such as *D. millerae*.

#### Paleogeography and Biostratigraphy of *Diaulax*

The pattern of evolution of *Diaulax* is one of initial derivation from ancestral stock in the Jurassic in Central and Northern Europe (Glaessner 1931:4; Wright & Collins 1972: 55), emigration and adaptive radiation in the shallow waters of the northern Tethys in Texas and southern England, followed by emigration and speciation in the opening Atlantic on the Northern Atlantic Coastal Plain. The species assignable to the genus *Diaulax* show an interesting pattern of development and evolution indicating an origin in the northern Tethys Seaway in the Early Cretaceous possibly, migration and evolution in the shallow waters of the northern Tethys in southern Great Britain (*D. oweni* Bell 1850, and *D. feliceps* Wright & Collins 1972), then migration and evolution

	North America				Europe
	Pacific Slope	Western Interior	Gulf Coastal Plain	Atlantic Coastal Plain	Great Britain
Paleocene					
Maastrichtian					
Upper Campanian				 Diaulax millerae 	
Lower Campanian					
Santonian					
Coniacian					
Turonian					
Cenomanian					 Diaulax oveni     Diaulax feliceps 
Upper Albian					
Middle Albian					
Lower Albian			 Diaulax roddai 		
Aptian					
Neocomian					

Fig. 2. Stratigraphic sequence and approximate geographic position of described species of *Diaulax*.

on the Northern Atlantic Coastal Plain (*D. millerae*, new species). Carter (1898:20), and subsequently Wright & Collins (1972), cite the existence of a yet unsubstantiated, undescribed species of *Diaulax* from the Oligocene or Miocene of England.

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Acknowledgments

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